When lab tests confirmed an outbreak of a highly virulent virus in Rwanda's capital, Kigali, health minister Dr Sabin Nsanzimana knew he had to think outside the box.

"I had some pain at the injection site and experienced chills, but otherwise felt fine throughout the process. […] I believe I could have been exposed to the disease – given my high-risk work environment – but the vaccine helped create immunity, which I expect will be confirmed by the serology testing." Dr Menelas Nkeshmiana, physician and trial vaccine recipient.

Although it was the first time that the east African country was experiencing the Ebola-like outbreak, Nsanzimana had watched the virus kill dozens in neighbouring Tanzania and Equatorial Guinea in 2023. The virus spreads from person to person through contact with blood and other bodily fluids of infected individuals and can cause victims to haemorrhage, and Nsanzimana knew that there was no approved vaccine against the pathogen yet on the market.

He needed to come up with a strategy to stop the virus — and very fast. He grabbed his phone and made several calls.

Within 72 hours, the east African country had developed a comprehensive plan to identify, isolate and investigate suspected cases to control the outbreak.

"We promptly declared the outbreak and established a multidisciplinary command post with specialised response pillars," said Nsanzimana in an interview with *VaccinesWork*. "We set up a robust contact tracing mechanism, with particular emphasis on ensuring that new cases were identified exclusively from our monitored contact list – a strategic approach that proved crucial in preventing community transmission."

The response team tested more than 7,000 people for the virus. Confirmed cases, a total of 66 people, were treated at a designated centre in the capital Kigali. But Nsanzimana and team needed additional prevention tools, including vaccines and other antivirals to stop the virus.Have you read?

Enter the vaccine

Though MVD didn't have an established vaccine, research to find one was well underway. Scientists were testing a promising candidate created by the Sabin

Vaccine Institute in a phase 2 trial in 125 healthy adults in Kenya and Uganda. That trial's predecessor, a phase 1 trial, had suggested the vaccine candidate was "safe and elicited rapid and robust" immune responses in 40 healthy United States adults. So, Nsanzimana and team contacted Sabin to ask if they could deploy the investigational vaccine in Rwanda, in a bid to curtail the outbreak.

The response was prompt. On 5 October, nine days after Rwanda confirmed the outbreak, Sabin delivered its first shipment of 700 vaccines to combat the virus. The response team began vaccinating frontline health workers and contacts of confirmed cases the next day. Sabin delivered a second batch of 1,000 investigational vaccines to Kigali a week later (on 12 October) and a third shipment on 31 October.

The response team administered the single-dose vaccine strategically, prioritising the most-at-risk and tracking the roll-out as part of a phase 2 open-label trial reviewed by Rwanda's ethics and regulatory authorities, said Nsanzimana. More than 1,600 people receivedthe vaccine.

The vaccine was not Rwanda's only line of defence against the virus, however. The team also administered experimental remdesivir, which can inhibit the replication of viruses, as well as the neutralising monoclonal antibody (MBP091), which is designed to replicate the antibody proteins that the body naturally produces to defend itself against pathogens. They also used remdesivir as part of a post-exposure prophylaxis protocol for all high-risk individuals exposed to the virus.

Fewer deaths

The interventions worked. While 15 people died of the virus, 51 recovered, limiting the case fatality rate (CFR) to 22.7%, one of the lowest ever recorded in the history of viral haemorrhagic fevers (VHFs). Marburg is considered one of the deadliest human viruses known to science, recording case fatality rates as high as 88%.

"While we acknowledge the precious lives lost, achieving a CFR as low as 22.7%, one of the lowest recorded for viral haemorrhagic fevers, stands as a testament to Rwanda's efforts in building a strong health system, our international partners' invaluable support, but more fundamentally, the unwavering solidarity of the Rwandan people, who demonstrated extraordinary resilience and cooperation throughout this challenging period," said Nsanzimana.

“Our intensive contact tracing combined with the implementation of new therapeutics were particularly effective in controlling the outbreak,” he continued. “The investigational vaccine played a critical role in protecting high-risk individuals, including health care workers and close contacts of confirmed cases. Follow-up serological tests have been conducted at 14 and 28 days post-vaccination, and I believe the results will prove its efficacy.”

Africa CDC commended Rwanda’s “immediate and comprehensive response” to thwart the outbreak and stop it from spilling over to neighbouring countries.

“They [Nsanzimana and team] achieved a CFR estimated at 22.7% – that is much lower than has been registered in previous outbreaks where CFR has been between 24% and 88%,” underscored Dr Ngashi Ngongo, principal advisor to the director-general of Africa CDC.

“The low CFR benefited from the (experimental) vaccines and standard of care at the different treatment facilities,” said Ngongo, at a press briefing hosted by Africa CDC on 19 December. “Most of these vaccines help with prevention (of diseases) and where people who are vaccinated still catch the disease, vaccines help to reduce the severity.”

End of the outbreak, not of the threat

Dr Menelas Nkeshimana, who received the investigational vaccine while working as a frontline healthcare provider at a treatment centre in Kigali, said his experience was “relatively straightforward”.

“I had some pain at the injection site and experienced chills, but otherwise felt fine throughout the process,” he said. “The Ministry of Health team conducted thorough follow-up monitoring for 29 days post-vaccination. I believe I could have been exposed to the disease – given my high-risk work environment – but the vaccine helped create immunity, which I expect will be confirmed by the serology testing.”

On December 20, less than three months after Nsanzimana and team announced the outbreak, health leaders gathered in the capital Kigali to mark its end.

But all is not done. Nsanzimana said they will continue to track survivors for about six months, to monitor for any potential clinical complications, and to be sure that the virus has been cleared.

After genomic sequencing linked the outbreak's "patient zero" to viral strains found in fruit bats in a mine, the country will continue to implement a comprehensive cave mapping strategy using a One Health approach. The aim is to understand and mitigate the risks associated with fruit bat habitats, particularly those housing the *Rousettus aegyptiacus* species.

"In high-risk areas, we are conducting regular bat population surveys and biological sampling to monitor viral presence through our ongoing surveillance programme," Nsanzimana said. "We are working closely with local communities, through targeted risk communication and engagement initiatives, to minimise human-bat interactions."

The team is also conducting regular serological surveys in surrounding communities to detect any evidence of viral exposure.

Ngongo said the continent needed to build on Rwanda's success to improve surveillance for VHFs. "There are lots of things that we can learn from Rwanda. But the first one is leadership," said Ngongo. "We saw during the weekly teleconferences that the minister was on top of the situation. He had a dedicated team right at the start of the outbreak."

Apart from this, the country had a strong surveillance system. "Most of the new cases that were reported came out of the contact lists," said Ngongo. "Immediately they confirmed a case, they listed all the contacts and established a monitoring system that tracked them and picked those that developed symptoms."

The rest of Africa can also learn from Rwanda's laboratory system. "The country had 100% testing rate, and the turnaround of results was very short," said Ngongo. "They had a holistic approach to care at their treatment centre."

Original article

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